Some Grafting Experiments upon Lepidoptera. H. E. Crampton, Jr.

The writer described a series of experiments carried on during the spring of 1897, preliminary to a full series now in progress. The operations were performed on pupæ of the commoner Saturniidæ: *P. cynthia*, *S. cecropia*, *C. promethea* and *T. polyphemus*. They were designed to determine, if possible, besides the coalescence power of fragments or nearly complete pupæ, as well the color effect, if any, of each component upon the other. As shown by Mayer and others, the pigmental colors are produced by the chemical decomposition of the blood in the empty scale cells; and, therefore, if two specifically different forms were coalesced, reciprocal color-effects might be looked for.

Photographs and specimens illustrating the types of operations, as well as some coalesced imagines, were exhibited. The first group of operations included homoplastic and heteroplastic unions in natural proportions of anterior and posterior halves of pupæ. Four out of sixty-one furnished metamorphosed imagines, with the parts perfectly coalesced. A hinder part of the abdomen of a *promethea*, fused to a *cynthia*, showed a buffy color, with no trace of its specific red color.

'Tandem' unions formed the second group. In these, two pupæ, one deprived of its head and the other of the posterior part of its abdomen, were joined. Three out of twenty-seven operations proved successful, producing compounds with four pairs of wings, six pairs of legs, etc. In heteroplastic operations no *definite* abnormal color-effects were observed.

'Twin' unions afforded fourteen pairs of coalesced imagines from a total of sixty-nine operations. Head to head, back to back, tail to tail, and other unions were obtained. No pairs among the heteroplastic operations showed any reciprocal color-effect whatever.

Regeneration in Planaria maculata. T. H. Morgan.

The remarkable power of regeneration of Planarians has been known for a long time. The more recent results of Van Duyne and Randolph have added many new facts to those already known. The following account gives a few additional observations and experiments to those previously published. If the planarian (*Planaria maculata*) is cut into cross-pieces all the pieces make new worms unless they be too small. The piece in front of the eyes does not seem to be able to regenerate. Other experiments show that this piece is near the linear limit of size below which a piece does not regenerate. In the more anterior cross-pieces the new pharynx appears near the posterior end of the piece; in the more posterior pieces the new pharynx appears in the middle of the piece, and in the last piece the new pharynx appears in the middle of the old tissue. Longitudinal pieces cut from the side of the worm, generally form new long worms with the pharynx along the line between the old and new tissue, sometimes, however, in the old tissue. The new median line is often along the middle, or a little to one side of the middle, of the old tissue. Not infrequently these long pieces from the side develop differently. They shorten and become crescentic in shape, with the cut edge in the concavity of the crescent. Along the new edge new tissue develops and completely fills up the crescent. This new tissue soon develops into a head, with eyes and brain. The median plane of the new animal is at right angles to that of the original worm. These pieces never elongate, since there is an unbroken ectoderm behind, that originally formed the side of the worm.

Other experiments showed that almost any part of the old tissue had the capacity to form a new pharynx, but the head with

its eyes and brain, etc., never formed out of old tissue, but always from new tissues.

In one case two heads formed on opposite sides of a short cross-piece that had been cut from the middle of the body. The head, therefore, had the normal orientation of the piece, while the other, turned in the opposite direction, had its orientation exactly reversed.

Regeneration and Grafting in Cordylophora. G. LEFEVRE. (Presented by E. A. Andrews.)

THE stems of Cordylophora, when cut in pieces, exhibit the heteromorphic formation of hydranths, as has already been observed in this hydroid.

The cœnosarc regenerates the new hydranth at the cut end by a distinct process of budding, growing out beyond the old perisarc into a knob-like projection which acquires the rudiments of tentacles in from 36 to 48 hours. This is not merely a direct transformation of the tissues of the stem into the body portion of the hydranth unaccompanied by growth, as has been described for other Tubularian hydroids, but the process is in truth a regeneration or new formation.

A piece of stem invariably regenerates a new hydranth at each end, even when lying on the bottom of a dish. Usually a foot is formed when a stem is brought in contact with a solid object, but in several cases it was found that a hydranth arose at the end which was firmly attached to the dish, the hypostome acting as the organ of attachment. This inverted hydranth did not attain to complete development, but it was a distinct hydranth provided with several short tentacles.

Only negative results were obtained from isolated tentacles, as no regeneration took place, the tentacle soon contracting into a rounded mass and dying.

Grafting may be successfully performed on the stems of Cordylophora. When freshly cut pieces are brought into contact, end to end, a firm, complete, permanent union takes place. Ectoderm unites with ectoderm, endoderm with endoderm. There is no polar differentiation in regard to the ability of the stems to fuse with each other, and in the experiments which were made, series of fused pieces were obtained representing all the possible combinations of the two poles. The united stems did not eventually break apart, but remained intact until they finally died *in toto* after several days. At the point of union between two pieces a lateral branch was given off in many cases, each portion apparently contributing equally to the branch.

A Recent Variety of the Flatfish, and its Bearing upon the Question of Discontinuous Variation. H. C. BUMPUS.

IT was shown that within the past five or six years the lower side of the flatfishes (*Pleuronectes Americanus*) from Woods Holl, Narragansett Bay and Long Island Sound has, with great frequency, become deeply pigmented over more or less definite tracts.

The abrupt appearance of a large number of individuals, varying in a definite direction, bears directly upon many current speculations of organic evolution. It was claimed that the variation being so widespread must have been the result of some environmental stimulus upon the germ, since the arrangement of the color precludes the possibility of its being the result of the direct action of light, and there is evidence to prove that the appearance of 'piebald' specimens was not due to the invasion of piebald fish from other localities.

It was also claimed that the process of natural selection could not have been materially instrumental, since the presence of the piebald specimens was first indicated by a large number of young fish, and because the time has been too brief for nat-